Appendix A

Geologic Hazards Evaluation

Prepared by Kleinfelder, Inc.

[redacted]

GEOLOGIC HAZARDS EVALUATION
111 CALEXICO PLACE
JASPER ROAD AND STATE HIGHWAY 111
CALEXICO, CALIFORNIA

August 16, 2006

KLEINFELDER
An employee owned company

August 16, 2006
Project No. 74439

Melyssa Sheeran
HDR Consulting
8690 Balboa Avenue, Suite 200
San Diego, California 92123

Subject: **Geologic Hazards Evaluation**

Project: **111 Calexico Place Mixed Use Project**
Calexico, California

Dear Ms. Sheeran:

As you requested, we have performed a geologic hazards assessment for input to the EIR for the 111 Calexico Place mixed use development project in Calexico, California. The results of our work are presented in this report.

We appreciate the opportunity to provide this report and look forward to working with you on this project. If you have any questions or need additional information, please contact the undersigned at (858) 320-2000.

Sincerely,

KLEINFELDER, INC.

Barry R. Bevier

REGISTERED PROFESSIONAL ENGINEER
BARRY R. BEVIER
No. 143
EXP. 12/31/06
GEOTECHNICAL
STATE OF CALIFORNIA

Barry R. Bevier, GE 143
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1.0 SITE CONDITIONS

The proposed 111 Calexico Place site is southwest of the intersection of Jasper Road and State Highway 111 in the City of Calexico, California (see Vicinity Map and Site Map, Figures 1 and 2). It consists of a roughly 200 acre irregular shaped parcel bordered by Jasper Road on the north, State Highway 111 on the east and a main irrigation canal along the west and south property boundaries. The site has been used historically for agriculture but currently is fallow and undeveloped. The elevation is at sea-level (0 feet MSL) and the surface topography is essentially flat.

Land use around the site consists of agriculture to the west, north and east. Commercial sites are located directly south of the property on the opposite side of the irrigation canals. A geothermal electrical generating facility is located just northwest of the property. This facility is part of the Heber Field Company. The map by Russell Associates (2004) shows the western portion of the site within the southeastern most corner of unit field. All producing wells are located northwest of the site, the closest being approximately 0.5 miles away. The canal system along the south and west property boundaries actually consists of two parallel canals contained within a set of two side levees and an intermediate levee which divides the two canals. The canals are higher than the adjacent agricultural land in order to provide a proper gravity gradient to irrigate the surrounding fields. A small concrete lined irrigation swale borders the south and west sides of the property which is connected to the main canal system. This channel is currently not in use.

We anticipate that the past agricultural grading of the property disturbed at least the upper 12 to 18 inches of the surface soils. It is probable, that prior to the original agricultural grading of the site, that minor topographic surface deviations such as depressions or small drainage features may have been present. We anticipate that these features would have been no more than several feet in depth and therefore localized areas of undocumented fill below the depth of the annual agricultural grading may be present at the site.

2.0 GEOLOGY

2.1 REGIONAL GEOLOGY

The site is located within the central, southern portion of the Colorado Desert geomorphic province (Norris and Webb, 1990) of California. This province consists of a low-lying fault bounded tectonic graben that stretches south from the southeastern boundary of the Transverse ranges approximately 100 miles to beyond the Mexican border. It is bounded on the west by the mountains of the Peninsular Ranges and on the east by the Mojave Desert and is nearly 75 miles wide (measured east to west) at the international border. A large portion of the central part of the basin is below sea level with a low of approximately -245 feet MSL (mean sea level) at the Salton Sea.

The central part of the graben basin, which encompasses the subject site, is underlain by a thick deposit of Pliocene to Pleistocene age sediments. Geophysical studies indicate the these sediments may be up to 15,000 feet thick and were deposited on basement material comprised of igneous and metamorphic rocks. The basin has filled with water from the Colorado River several times during the late Pleistocene up through just several hundreds years ago, creating large lakes far above the present level of the Salton Sea. One of the largest lakes (known as Lake Cahuilla) reached an elevation of 44 feet MSL. Shoreline benches and tufa deposits (carbonate) occur at many locations around the perimeter of the lake basin. These series of ancient lakes deposited a cover of lacustrine sediments across the basin floor (see Regional Geologic Map, Figure 3). These lake deposits have been mapped throughout the Calexico area, including the subject site.

This region is also a center of geothermal activity. The tectonic forces, which created the basin, also resulted in the thinning of the continental crust in this area. In fact, it has been suggested that new crust is actually being created at depth below the basin due to rifting and intrusion of magma. Evidence for this occurs on the southeast shore of the Salton Sea where up to 5 volcanic domes (known and Salton Buttes) outcrop at the surface. This area thus has a very high heat flow rate with subsurface temperatures of up to 360 degrees centigrade at depths as shallow as 1 mile.

2.2 SITE GEOLOGY

Review of geologic maps indicate the site is directly underlain by geologic units comprised of lake deposits of the ancient Lake Cahuilla. The depth of these deposits reach a maximum of up to several hundred feet, thinning toward the edges of the lake basin, and consist primarily of sands, silts and clays beneficial to the agricultural usage. The lake units have been deposited over older sediments (Pliocene to Pleistocene in age), which may be up to 15,000 feet thick below the site.

2.2.1 Structure

In general, the geologic units are relatively flat lying and we anticipate that the geologic material will be relatively continuous and uniform below the site.

2.2.2 Groundwater

We did not observed groundwater seeps within at the site during our recent site visit. We anticipate perched groundwater conditions due to the historic and present irrigation within this area and the presence of the main canal structures directly adjacent to the south and west property boundaries.

3.0 TECTONIC SETTING AND FAULTING

3.1 REGIONAL SETTING

Tectonism and faulting in the southern California region is controlled by strain release across the San Andreas Fault System, which delineates the boundary between two global tectonic plates consisting of the North American Plate on the east and the Pacific Plate on the west. The San Andreas fault stretches from the Gulf of California in Mexico along a northwest alignment through the Imperial Valley region of Southern California up to Northern California, where it eventually trends offshore north of San Francisco. Right lateral slip movement along the plate boundary of the San Andreas fault is by far the most dominant factor controlling the seismicity throughout northern and southern California (Wallace, 1990; Weldon and Sieh, 1985). Within Southern California, the strain associated with the plate boundary movement extends well westward for up to 150 miles (241 kilometers) from the main San Andreas fault strand in the Imperial Valley to well offshore of San Diego. The Imperial Valley is one of the most seismically active regions in the world.

The major fault systems that control the seismicity of the Imperial Valley region (from east to west) include the San Andreas fault, the San Jacinto fault and the Elsinore fault (see Fault and Epicenter Map, Figure 4). Most of the seismic energy and associated fault displacement occurs along the fault structures closest to the plate boundary on the Elsinore, San Jacinito, and San Andreas faults. Approximately 49 mm/yr (1.9 inches/yr) of overall lateral displacement has been measured geodetically and as fault slip across the plate boundary. The Elsinore, San Jacinto, and San Andreas combined account for up to 41 mm/yr (1.6 inches/yr) of the total plate displacement (84%), meaning that the remaining 8 mm/yr (0.3 inches) or 16% is accommodated across the faults to the west (Bennett, et al, 1996). Although the overall sense of displacement on these fault is right lateral, within the Imperial Valley there is a significant vertical component of displacement due to rifting and subsidence of the crust. This has resulted in a pull-apart basin (graben) with tens of thousands of feet of vertical offset. This graben has been filled with an equivalent depth of sediment.

3.2 LOCAL FAULTING

Several active fault structures are located nearby the site. The closest active fault is the Imperial fault, which is located approximately 5 miles northeast of the site. This fault has had recent earthquakes with mapped ground rupture in 1940 and 1979. The 6.6

magnitude 1979 event resulted in ground rupture of approximately 20 kilometers in length and caused considerable damage to structures in the region. The next closest active fault is the southern end of the Superstition Hills fault, which is located 10.5 miles northwest of the site. This fault last ruptured in 1987 in a 6.6 magnitude event with up to 20 miles of surface displacement. Both of these faults are part of the San Jacinto fault system, which is the most active fault system in California.

4.0 GEOLOGIC HAZARD ASSESMENT

Kleinfelder has performed a geologic reconnaissance and evaluation of the site in regards to potential geologic and/or seismic hazards. These hazards include landslides, liquefaction, fault rupture, seismic shaking, tsunamis, flooding, expansive soils, and collapsible soils. The following sections discuss these hazards and their potential impact at this site in more detail.

4.1 LANDSLIDES

Landslides are deep-seated ground failures (several tens to hundreds of feet deep) in which a large arcuate or wedge shaped block of a slope detaches and slides downhill. Landslides are not to be confused with minor slope failures (slumps), which are usually limited to the topsoil zone and can occur on slopes composed of almost any geologic material. Landslides can cause damage to structures both above and below the slide mass. Structures above the slide area are typically damaged by undermining of foundations. Areas below a slide mass can be damaged by being overridden and crushed by the failed slope material.

Due to the flat topographic relief of the site and adjacent areas, the hazard with respects to landsliding would be low.

4.2 LIQUEFACTION

Liquefaction is a phenomenon whereby a loose (unconsolidated) cohesionless saturated soil looses its shear strength (liquefies) during periods of oscillatory ground motion caused by an event such seismic shaking induced by an earthquake. Liquefied soils undergo significant loss in support capacity, which can result in catastrophic settlement of structures. Soils prone to liquefaction consist of poorly consolidated sands and sandy silts in areas of high groundwater. These types of soils are typically deposited within low-lying drainage channels and alluvial valleys influenced by fluvial processes.

Regional geologic interpretations indicate that the soils below the site contain a large percentage of fine grained silt and clay material. However, sands and silty sands are known to occur within the lake deposits. We also anticipate possible perched groundwater at the site due to the addition of water from agricultural irrigation. Based on these potential site conditions, liquefaction is considered a possible condition at the site and should be evaluated during a geotechnical study.

4.3 FAULT RUPTURE

The closest mapped active fault (Imperial fault) to the site is located approximately 5 miles to the northeast. Based on this and the current geologic knowledge of faulting in this region the hazard within respects to ground rupture from faulting would be low.

4.4 SEISMIC SHAKING

Since this site is located in the seismically active Southern California region, structures built on the site will be subjected to seismic shaking during their lifetime. The Imperial Valley is located in one of the most seismically active regions of the world. Ground motion at the site estimated through the California Geologic Survey website indicate maximum accelerations of approximately 0.53g at a 10% probability of being exceeded in a 50 year period. To mitigate the effects of seismic shaking, the proposed improvements should be designed in accordance with the latest (2001) edition of the California Building Code (CBC) for Seismic Zone 4.

4.5 TSUNAMIS

Tsunamis are large, broad sea waves that result in response to large vertical displacement of ocean bottom faults or movement of submarine landslides. The resultant wave can travel at hundreds of miles an hour over thousands of miles across the ocean. Near shore, the waves increase in height and shorten in wavelength and can run-up for great distances inland. The distance of run-up is based on the amount of ground surface relief of the coastal region and the size of the Tsunami wave. Tsunami hazard due to submarine faulting or landsliding from both near field and far-fields sources are considered as probable hazards for the California coast. Based on the great distance of the site from the Pacific Ocean and Gulf of California, the hazard with respects to tsunamis would be low.

4.6 FLOODING

The Federal Emergency and Management Administration (FEMA) maintains a collection of Flood Insurance Rate Maps (FIRM), which cover the entire United States. These maps identify those areas, which may be subjected to 100-year and 500-year cycle floods. The site is included on Imperial County FEMA flood map Panel 1025, dated 1984. Our review of the map panel shows that the site is not mapped within either a 100-year or 500-year floodplain.

4.7 EXPANSIVE SOILS

Expansive soils are characterized by their ability to undergo significant volume changes (shrink or swell) due to variations in moisture content. Soils prone to these effects are fine-grained clays and sometimes silts. Changes in soil moisture content can result from precipitation, site irrigation, utility leakage, roof drainage, perched groundwater, drought, or other factors and may result in unacceptable settlement or heave of structures or concrete slabs supported on grade. Due to the apparent fine grained clay content of the site soils we anticipate that expansive soils may be present at the site.

4.8 COLLAPSIBLE SOILS

Collapsible soils are comprised of low-density open grain soil material with a high void ratio. These soils can support light to moderate building loads often for years with no noticeable adverse settlement. However, when these soils become saturated under load, the open grain lattice structure fails due to hydro-consolidation resulting in settlement (collapse). Soils most prone to collapse typically consist of recently laid alluvial sands and silty sands deposited during flash flood type events in desert environment. We do not anticipate that the soils underlying the site are of the type that would be subject to collapse but do to the desert environment it and may be possible some layers of collapsible soils may be present at the site.

5.0 SUMMARY OF GEOLOGIC IMPACTS AND MITIGATION MEASURES

We did not find significant hazard at the site with respects to landsliding, liquefaction, fault rupture, tsunamis, or flooding. Ground shaking from earthquakes on nearby faults is considered the most prominent hazard at the site. The impact of seismic shaking is a regional hazard that affects the entire Imperial Valley. We do not find, at this reconnaissance level of study, any conditions at the site that would indicate that the magnitude of shaking would be any greater than at other sites in the general vicinity. Other potential impacts at the site would be liquefaction, expansive soils and collapsible soils. These three potential conditions should be evaluated during a geotechnical study of the site and if present, appropriate recommendations to mitigate these conditions can be specified. It should be noted that these potential conditions are not considered specific to the site. This conditions are regional in nature and would be considered for nearly all of the other sites in this region of the Imperial Valley.

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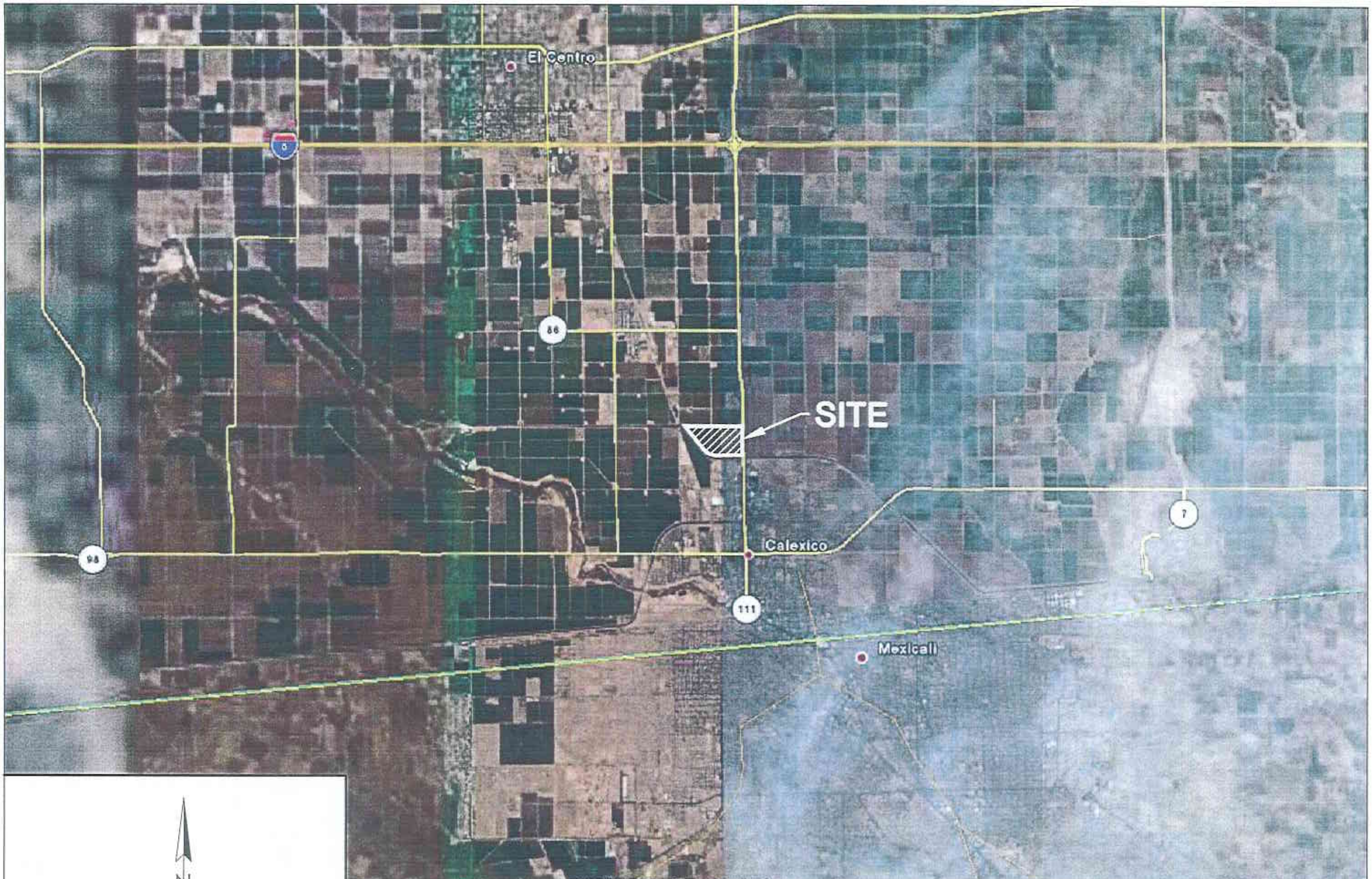
FIGURES



N

NOT TO SCALE

KLEINFELDER

5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122

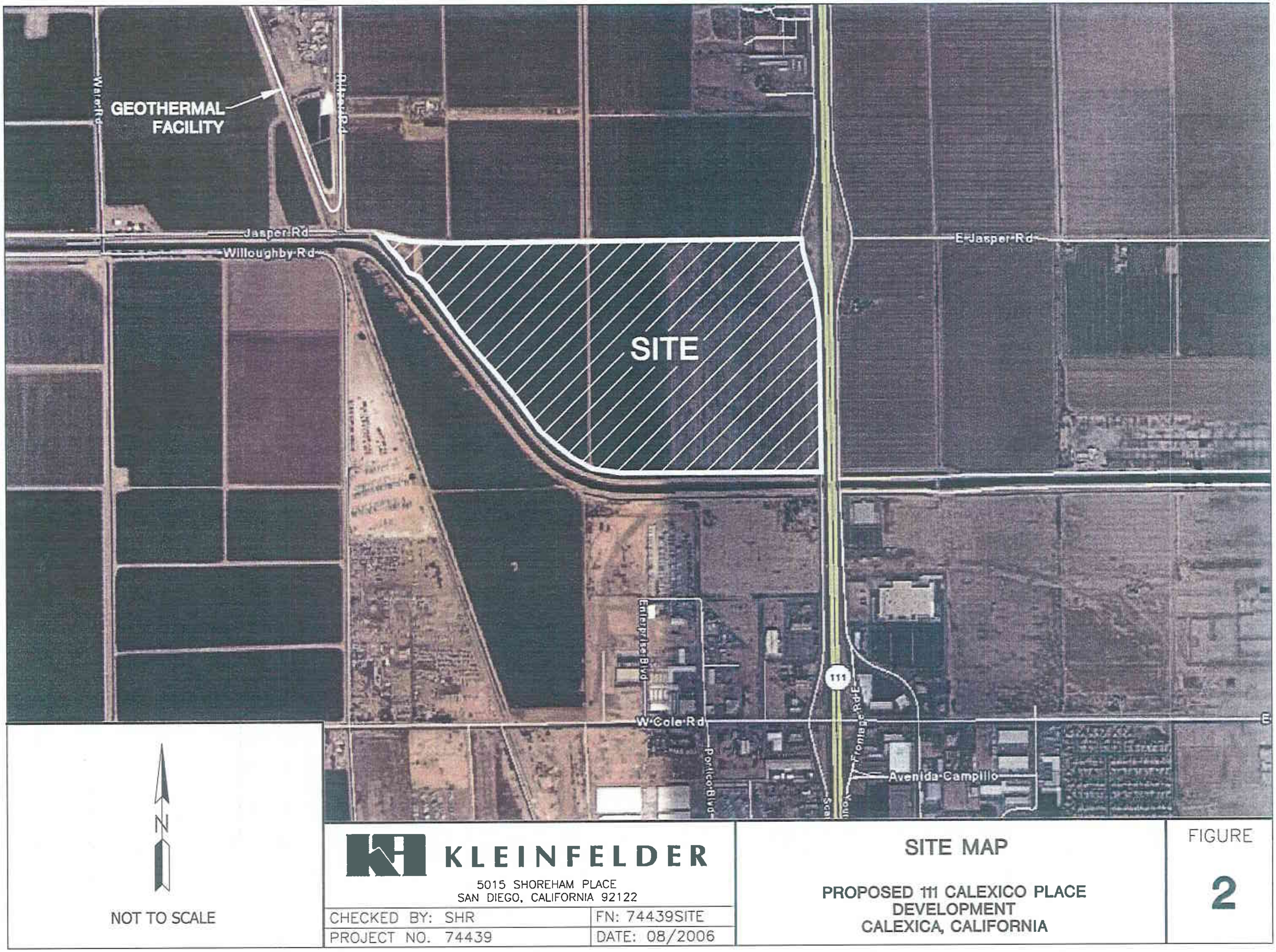
CHECKED BY: SHR	FN: 74439SITE
PROJECT NO. 74439	DATE: 08/2006

VICINITY MAP

PROPOSED 111 CALEXICO PLACE
DEVELOPMENT
CALEXICA, CALIFORNIA

FIGURE

1



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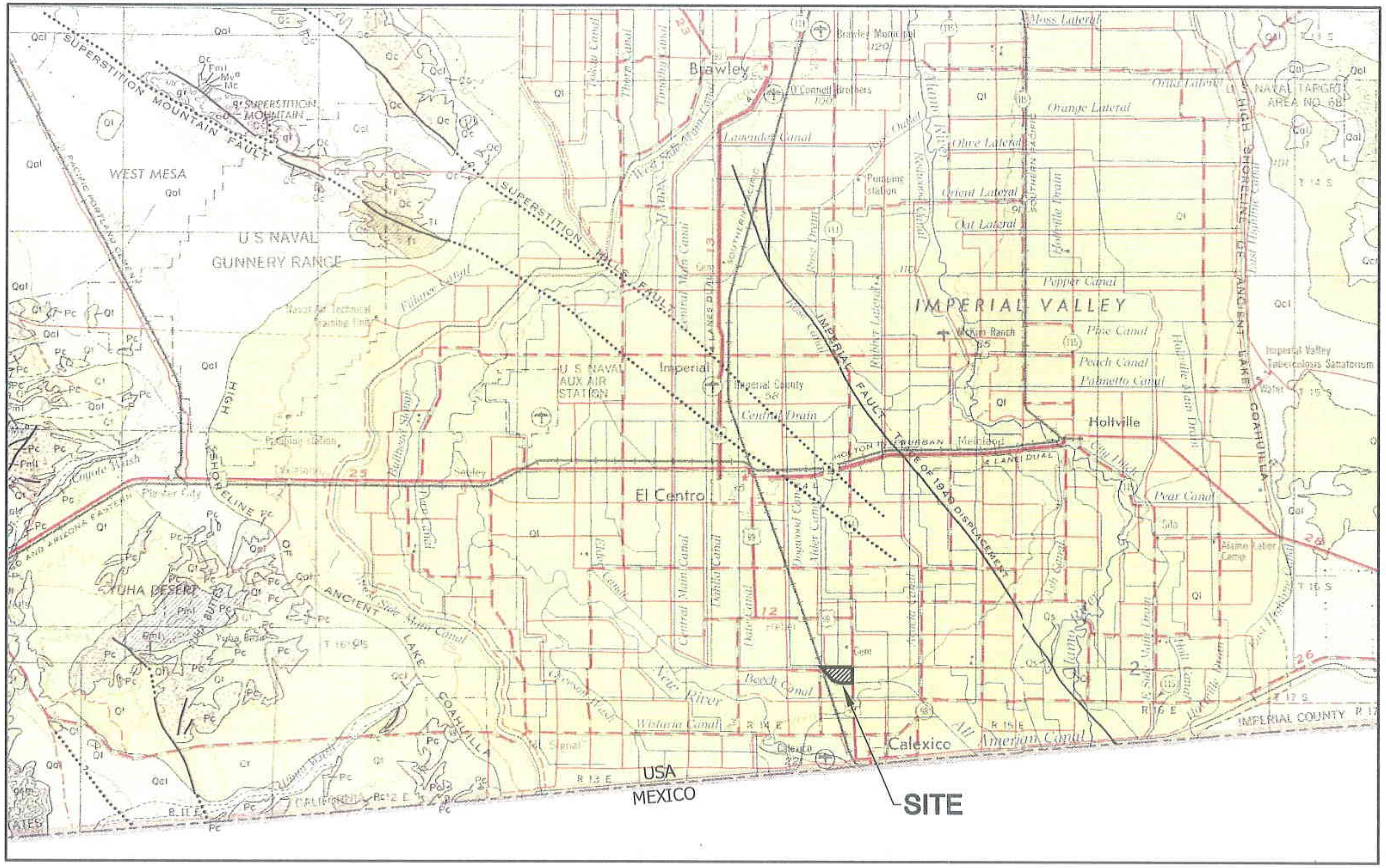
CHECKED BY: SHR	FN: 74439SITE
PROJECT NO. 74439	DATE: 08/2006

SITE MAP

PROPOSED 111 CALEXICO PLACE DEVELOPMENT
CALEXICA, CALIFORNIA

FIGURE
2



LEGEND:

Qs	DUNE SAND
Qal	ALLUVIUM
Ql	QUATERNARY LAKE DEPOSITS
Qt	PLEISTOCENE NONMARINE
gr	MESOZOIC GRANITIC ROCKS:

N

0 5 10

(MILES)

FROM:

GEOLOGIC MAP OF CALIFORNIA
SAN DIEGO-EL CENTRO SHEET
CALIFORNIA DIVISION OF MINES & GEOLOGY, 1962

KLEINFELDER
5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122

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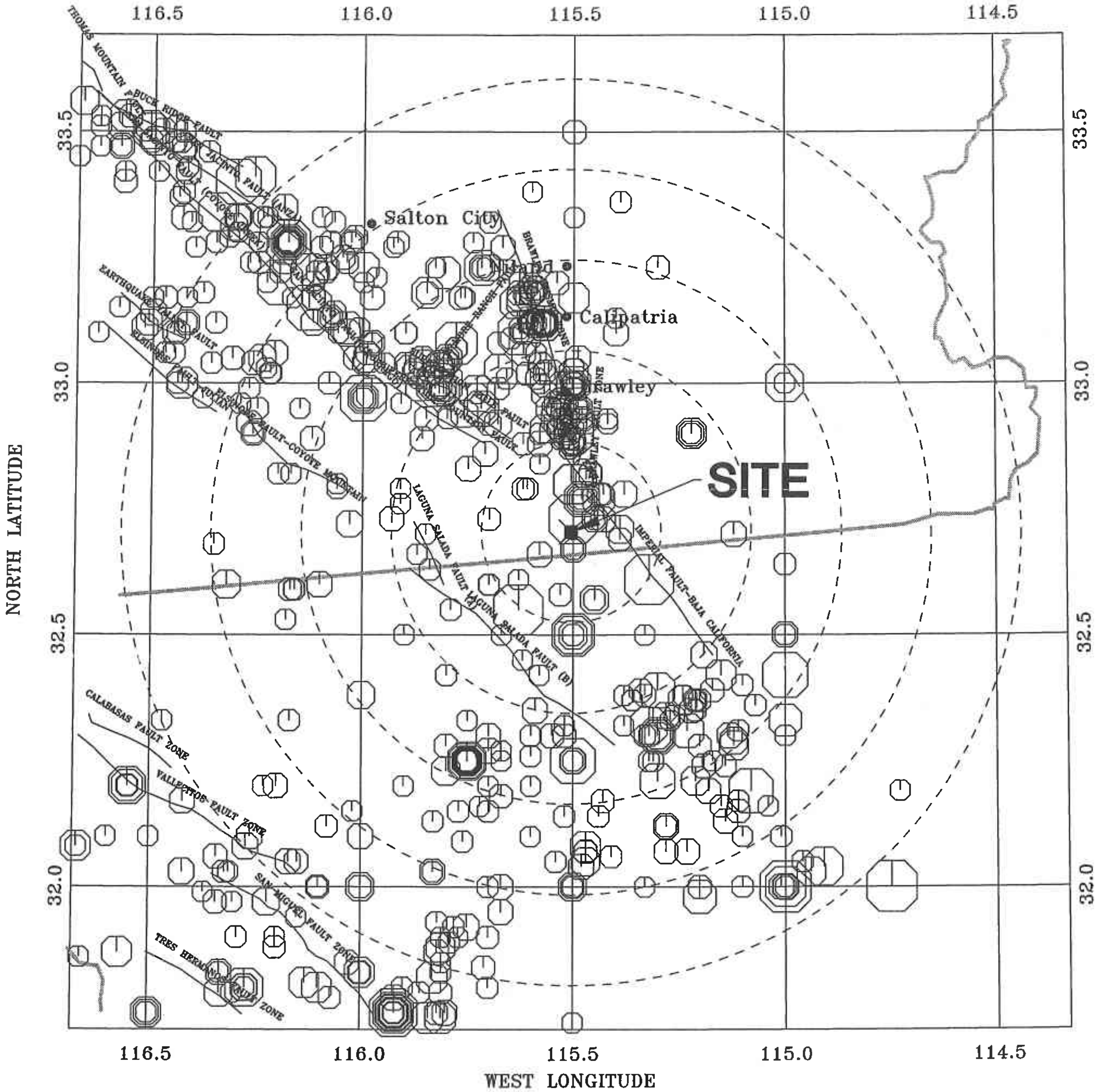
PROJECT NO. 74439	DATE: 08/2006

REGIONAL GEOLOGY MAP

PROPOSED 111 CALEXICO PLACE DEVELOPMENT
CALEXICA, CALIFORNIA

FIGURE
3



MAGNITUDE	:	4	5	6	7	8
SYMBOL	:					

FAULT MAP AND EPICENTERS OF EARTHQUAKES

PROJECT LOCATION 32.7048N -115.5052W

RADIUS OF LARGEST CIRCLE IS 100 KM

File: C:\GEOFALT\CALMAP.dat

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5015 SHOREHAM PLACE
SAN DIEGO, CALIFORNIA 92122

CHECKED BY: SHR	FN: 74439SITE
PROJECT NO. 74439	DATE: 08/2006

FAULT MAP AND EPICENTERS OF EARTHQUAKES

PROPOSED 111 CALEXICO PLACE DEVELOPMENT
CALEXICA, CALIFORNIA

FIGURE

4